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Simultaneity in Dispositional Interaction?

Penultimate Draft, Matthew Tugby

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Abstract: My aim is to question an assumption that is often made in the philosophical literature on dispositions. This is the assumption that, generally, the stimulation, or ‘triggering’ of a disposition temporally precedes the manifesting of that disposition. I will begin by examining precisely what the triggering of a disposition may be thought to consist in, and will identify two plausible views. I will then argue that on either of these views about triggering a case can be made against the view that the triggering of a disposition always occurs before the manifesting of that disposition. More precisely, if the first view about triggering is accepted, and certain plausible assumptions about dispositions are put into place, a metaphysical argument can be formulated for the claim that the stimulation of a disposition never occurs before that disposition manifests. If the second view about triggering is accepted, the question concerning simultaneity becomes an empirical one. There are, however, examples of dispositional interaction which, on this view about triggering, clearly seem to involve simultaneity.¹

¹ This research was supported by an award under the UK Arts and Humanities Research Council’s Metaphysics of Science Project (2006–2009). A version of this paper was presented at the Metaphysics of Science Colloque International held in Grenoble, December 2008. My thanks to Max Kistler for organising that great event. I have had the opportunity to discuss many of the issues covered in this paper during meetings of the Nottingham dispositions group, the members of which have included Rani Lill Anjum, D.M. Armstrong, Charlotte Matheson, Stephen Mumford and Markus Schrenk. Special thanks go to Stephen Mumford, Markus Schrenk and an anonymous referee for their invaluable comments on earlier drafts.

Introduction

The aim of this paper is to question an assumption that is often made in the philosophical literature on dispositions. This assumption is that the stimulation (or ‘triggering’) of a disposition temporally precedes the manifesting of that disposition. This assumption is sometimes implicit, but is often explicitly stated in discussions about dispositions, as will be demonstrated in the section to follow.

In order to understand this assumption, it is important to consider precisely what the stimulation of a disposition may be thought to consist in. Although ‘trigger’ and ‘stimulation’ are familiar terms in discussions about dispositions, little is often said about what precisely is meant by them. I will identify two alternative views about what the stimulation of a disposition consists in, each of which has some plausibility, and then I will argue that on either of these views, a case can be made against the claim that the triggering of a disposition always temporally precedes the manifesting of that disposition. This suggests that, at the very least, one should not take the assumption concerning temporal priority to be obviously true, as many seem to do.

This conclusion is by no means of minor importance, since the priority assumption figures in a variety of discussions on the topic of dispositions. As we shall see, the simultaneity conclusion has implications for conditional analyses of dispositions, dispositional accounts of causation, and also the way in which cases involving ‘finkish’ dispositions are understood.

The temporal priority assumption

Lewis and Bird are two philosophers who make explicit the assumption described above, that the stimulation of a disposition temporally precedes the manifesting of that disposition. In Lewis, for example, this assumption manifests itself in his reformed conditional analysis of dispositions (1997). Time variables t and t' are introduced into the analysis. The stimulus is said to occur at t , and the manifestation event, or ‘response’, is said to occur if the object (x) reaches t' without losing the property (B) that is the causal base of its disposition. Crucially, for our purposes, t' is explicitly said to be some time ‘after’ t :

‘Something x is disposed at time t to give response r to stimulus s iff, for some intrinsic property B that x has at t , for some time t' after t , if x were to undergo stimulus s at time t and retain property B until t' , s and x ’s having of B would jointly be an x -complete cause of x ’s giving response r .’ (Lewis, 1997: 157)

Whilst Bird does not support Lewis's reductive enterprise concerning dispositions, he does appear to support the thought that disposition stimulation occurs some time before the disposition in question manifests. For example, when discussing cases involving 'finkish' dispositions², in which an object loses its disposition before it can manifest that disposition, Bird characterises such cases as ones in which '... the object loses the disposition after the occurrence of the stimulus but before the manifestation can occur...' (Bird, 2007: 25). Clearly, Bird is here assuming the temporal priority of disposition stimulation.

What, precisely, does the stimulation of a disposition consist in?

Goodman once associated the disposition of flexibility (had by k at time t) with the following conditional: '[I]f k had been under suitable pressure at time t , then k would have bent' (1983: 35). Most, if not all philosophers hold there to be an intimate connection between dispositions and conditionals of one kind or another. As we saw above, Lewis holds this connection to be so strong that disposition ascriptions can be analysed in terms of such conditionals³. Now, the conditionals in question have the same general structure: that which we call the disposition's stimulus appears in the antecedent and that which we call the manifestation event figures in the consequent. In the case of flexibility, then, Goodman sees the application of pressure to k as the stimulus, with the bending of k being the manifestation of k 's flexibility. Another example of a disposition conditional can be found in C.B. Martin's work. In considering how one might cash out what it is for a wire to be live, the following conditional is suggested: 'if the wire is touched by a conductor then electric current flows from the wire to the conductor' (1994: 2). In this case, then, the stimulus would be classed as the contact of wire and conductor, with the manifestation being the flow of electrical current.

Now, each of these examples seems to offer a slightly different interpretation of what disposition stimulation consists in. It is noticeable that in the Goodman case, the stimulus involves *action*, i.e. the exertion of pressure, probably by a particular external to k . On the other hand, in the wire

² Incidentally, finkish cases are what Lewis's reformed conditional analysis is designed to accommodate.

³ Some philosophers in the dispositions literature, such as C.B. Martin, deny that disposition ascriptions entail, or can be reduced to, specific conditionals. However, Martin does concede that there is at least some connection between dispositions and conditionals; he writes that ascriptions of dispositions 'are *somehow* linked to (strict or strong) conditional statements' (1994: 2), but that such statements are only 'clumsy and inexact linguistic gestures to dispositions...' (1994: 8).

case, the stimulation event is static: it simply consists of the state of affairs of the wire and the conductor being in contact⁴.

It seems to me that it is more commonplace to view a stimulation event as something that involves activity⁵. However, there do seem to be cases, such as the Martin's, that lend themselves to the latter understanding of stimulation. Perhaps, in the end, we will have to accept a mixed view: some cases involve stimuli of the former kind and others the latter. The details need not concern us here, however. I will show that on either understanding of what disposition stimulation consists in, a case can be made against the thought that the stimulation of a disposition always temporally precedes the manifesting of that disposition.

First argument against the temporal priority of disposition stimulation

In this section I will assume the view that stimulation events involve the action of one particular upon another⁶. Then, I will argue that with certain plausible assumptions in place – most notably, assumptions about the reciprocity of dispositions – a metaphysical argument can be mounted against the temporal priority claim.

The general assumption needed to get my argument off the ground is that at least some properties bestow dispositions upon their possessors, dispositions that reveal themselves in the various behaviour their possessors exhibit. This assumption is loose enough to be accepted both by those who maintain that dispositions, or 'powers', are irreducible features of reality, as well as those who accept that ascriptions of unmanifesting dispositions can be truly made, but offer a reductionist account of those dispositions⁷.

⁴ This is what Martin would call a 'partnering' state of affairs (2008: 51)

⁵ According to the Aristotelian theory of powers, for example, the manifestation of a power, or 'effectivity' (*energia*) comes about as a result of the substance bearing the power (the 'patient') being subjected to the *operation* of another substance's power (see *Physics* book III).

⁶ Note that whilst triggering agents are usually external to the object with the disposition in question, this may not always be the case. Particulars that are very complex, such as organisms, may, it seems, have the ability to trigger certain of their own dispositions by acting upon themselves in a certain way. This complication need not concern us here, however.

⁷ Radical, Megarian-type actualists may resist even this assumption: Aristotle writes: '[T]here are some who say as the Megaric school does, that a thing 'can' act only when it is acting, and when it is not acting it 'cannot' act...' (1046b (2006: 3)). The argument that follows will therefore be of little interest to Megarians.

In the course of arguing to the overall conclusion, I will argue, in line with C.B. Martin, that there is a certain reciprocal relationship between a disposition and that disposition had by the triggering agent, such that the manifesting of each is dependent upon the manifesting of the other. This claim will form the backbone of the argument. Note that the principle of reciprocity to be endorsed here is not the same as that argued for by Le Poidevin (1988), which concerns causes and effects. Indeed, if the main claims of this section are correct, then the stimulus – manifestation distinction should be clearly separated from the cause – effect distinction, for reasons to be explained in the concluding remarks. Again, this observation is not of minor relevance for it is, I think, tempting to think of the cause – effect distinction simply in terms of the distinction between disposition stimulus and disposition manifestation.

Once the general form of the argument has been outlined, I will then elucidate terminology where necessary and make a case for acceptance of the more controversial premises. The relevance of each premise will also be explained⁸.

The argument

1. Premise: The manifesting of some disposition F of an object a cannot occur until it is stimulated by (acted upon) some triggering agent.
2. Premise: There happens to exist only one triggering agent for a 's disposition F ; call it b .
3. Premise: If b is able to act upon a in such a way as to prompt the manifesting of a 's disposition F , b must have a certain disposition which is bestowed by some property that b has; call this disposition G .
4. Intermediate conclusion 1: Therefore, the manifesting of a 's disposition F cannot occur until disposition G of its triggering agent (b) is manifesting. (1,2,3)
5. Premise: The manifesting of b 's disposition G cannot occur until G is also stimulated by (acted upon) a triggering agent.
6. Premise: A triggering agent for b 's disposition G is a itself.
7. Premise: a happens to be the only triggering agent that exists for b 's disposition G .

⁸ Premises 2 and 7, for example, may appear unnecessary at first glance, but will be explained in what follows.

8. Premise: If *a* is able to act upon *b* in such a way that the manifesting of *b*'s disposition *G* is prompted, *a* must have a certain disposition which is bestowed by some property that *a* has.
9. Premise: The disposition in virtue of which *a* is able to trigger *b*'s disposition *G*, is disposition *F*.
10. Intermediate conclusion 2: Therefore, the manifesting of *b*'s disposition *G* cannot occur until disposition *F* of its triggering agent (*a*) is manifesting. (5, 6, 7, 8, 9)
11. Premise: If the manifesting of *a*'s disposition *F* cannot occur until *b*'s disposition *G* manifests, and the manifesting of *b*'s disposition *G* cannot occur until *a*'s disposition *F* manifests, then neither *a*'s disposition *F* nor *b*'s disposition *G* can manifest before the other.
12. Premise: If neither *a*'s disposition *F* nor *b*'s disposition *G* can manifest before the other, then *a*'s disposition *F* and *b*'s disposition *G* must manifest simultaneously or not at all.
13. Conclusion: Therefore, if *a*'s disposition *F* and *b*'s disposition *G* are to manifest, they must manifest simultaneously (4, 10, 11, 12).

Premise 1 seems uncontroversial, given our earlier observations about the conditionality of dispositions⁹. Goodman's flexible object does not bend, for example, until pressure is exerted upon it.

Premise 2, which states that there happens to exist only one triggering agent for *a*'s disposition *F* (which we will call *b*), is inserted for the sake of simplification. What we are trying to do in the argument is focus our attention on what the relationship between two *particular* entities must be like if one of those entities is to stimulate a certain disposition of the other, in a specific, concrete interaction. This will remain clear if, by 'triggering agent *b*', we refer to a particular object rather than any one of a number of objects falling under a certain kind. Without this premise, the argument as stated would be invalid, as will become clear as the discussion proceeds (see discussion of premise 7).

⁹ Note, some philosophers claim that some dispositions do not require a trigger in order to manifest, such as the disposition of a particle to decay. Molnar, for example, characterises such dispositions as spontaneously manifesting dispositions (2003: 85). However, even if Molnar is right, it should be clear that the above argument is intended to apply only to those dispositions that do require stimulation.

Premise 3 states that if b is able to act upon a in such a way as to prompt the manifesting of a 's disposition F , b must have a certain disposition which is bestowed by some property that b has; call this disposition G . Recall that on the view of stimuli currently being assumed, stimulation consists in some triggering agent *operating* in a certain way upon the particular with the disposition in question. Premise 3 merely states that if b can behave in this way, then it must have a disposition that is responsible for that behaviour, a disposition bestowed by some property which it has. In the Goodman case, disposition G would correspond to, say, the disposition of a person to exert pressure upon k .

From these initial premises, the first intermediate conclusion follows (4): the manifesting of a 's disposition F cannot occur until disposition G of b is manifesting. If the manifesting of a 's disposition F depends upon its being triggered by the action of a particular triggering agent (b), and some disposition G of that triggering agent is responsible for its triggering behaviour, then what the manifesting of a 's disposition F depends upon, ultimately, is the manifesting of (b 's) disposition G .

Premise 5 states that, as with a 's disposition F , the manifestation of b 's disposition (G) cannot occur until it is stimulated by some triggering agent. Again, this seems uncontroversial; basic symmetry assumptions imply that there will be a conditional aspect to disposition G , as there is with disposition F .

Once it is acknowledged that a triggering agent will itself need to be acted upon in order for it to provide stimulation, one may worry that the danger of regress is lurking. That is, the triggering agent for a particular disposition would itself require a stimulus in order to manifest its disposition; this further stimulus would then require the action of a further triggering agent in order to make its contribution and so on, *ad infinitum*. If this were the case, the original disposition would never get around to manifesting, for it would have to wait for an infinite number of other actions.

If our premises thus far were to imply a regress, one or more of them must be faulty, because in reality the dispositions of things are, of course, able to be successfully manifested. Fortunately, our premises thus far do not imply a regress. Such a threat is prevented if it is the case that the triggering agent for b 's disposition G (which prompts F) just is object a itself. Given that b is also the triggering agent for a 's disposition F , what would we have, rather than a regress of triggers, is a relationship of *reciprocity*. When we consider individual cases of dispositional activity, it does

seem plausible that there is always a reciprocal relationship of this kind¹⁰. Consider, for example, the case of a charged particle accelerating through an electro-static field¹¹. In such a case, the field is the triggering agent for the particle's disposition to accelerate, in virtue of a certain power that the field has. But what is the triggering agent for the *field's* power? The answer is not that some further agent is required, because a particle's disposition to accelerate can be triggered by a field that is in isolation from any further states of affairs. The agent which prompts the field's power must therefore be the particle itself. This, I have suggested, must be the case generally if the prospect of triggering regresses is to be avoided. This leads us to premise 6, that the triggering agent for *b's* disposition G will be *a* itself.

Again, premise 7, that *a* happens to be the only triggering agent that exists for *b's* disposition G, is inserted in order to make the overall argument less complicated. The consequence of this premise, along with premise two, is that when we speak of the relationship between *a* and *b*, we are speaking of two particular objects which are the only existing triggering agents for the dispositions in question. This preserves the validity of the argument as stated for the following reason. The general conclusion of the argument is that in order for *a* to manifest disposition F, it must manifest simultaneously with the (reciprocal) disposition G of *b*. If premises 2 and 7 were omitted, allowing '*a*' and '*b*' to refer to any one of many dispositional objects of a certain kind, this conclusion could be false. This is because, for example, a particular cube of salt can obviously manifest its solubility in some water even if a portion of water *elsewhere* manifests its dissolving power at a quite different time.

Premise 8 states that the stimulation of *b's* disposition G by *a* will be accounted for in terms of some disposition bestowed by some property that *a* has. Again, this seems uncontroversial given the tolerant view of dispositions that we are assuming.

In order to appreciate premise 9, we must consider the following question: will the disposition had by *a* to prompt *b's* disposition G be disposition F itself or some further disposition? If the

¹⁰ C.B. Martin holds that all cases of disposition manifestation involve this kind of reciprocity (1993: 182). Heil has also made similar claims (2003: 198), although he rightly acknowledges that spontaneously manifesting dispositions, such as the disposition of a particle to decay, are the exception.

¹¹ I will continue to use this example throughout the course of this paper, for two main reasons. Firstly, it is a scientifically respectable example of dispositional interaction and so there will be no danger of the premises resting on the peculiarities of macroscopic examples. Secondly, the particle case involves a minimal number of elements and so is easier to work with.

disposition in question is F, then not only is there reciprocity between *a* and *b* as triggering agents, but also reciprocity between *a*'s disposition F and *b*'s disposition G. In other words, G will be the disposition in virtue of which *b* prompts *a*'s disposition F and, likewise, F will be the disposition in virtue of which *a* prompts *b*'s disposition G. If we deny this reciprocity, and seek an alternative story, the threat of regress once again appears. The alternative story would be that whilst *a* and *b* are reciprocal triggering agents, and that *b*'s disposition G is responsible for the triggering of *a*'s disposition F, it would in fact be some further disposition of *a*, call it H, that is responsible for *a*'s triggering of *b*'s disposition G. But then which disposition would be responsible for triggering *a*'s disposition H? If we deny that dispositions come in reciprocal groups, it can only be that *a*'s disposition H is triggered by some further disposition involved in the story, and so the regress begins.

Consideration of specific cases also indicates that the disposition which is prompted by a further disposition is also the very disposition responsible for the stimulation of that further disposition. Consider, as a concrete example, the case of a charged particle which finds itself in a force-field. As suggested already, it will be some power of the force-field that is responsible for stimulating the particle's disposition to accelerate, a disposition the particle has in virtue of being charged. Now, in virtue of which of the particle's attributes does the force field prompt the acceleration? The obvious answer is that the force field stimulates the particle's acceleration simply in virtue of the particle being *charged*: had the particle not been charged, it would not have accelerated through the force field. So, whilst the field's power is responsible for the manifestation of the particle's charge, the particle's charge is equally responsible for the exercise of the field's power. I suggest, therefore, that in the particle case, the particle's disposition of being charged and the field's reciprocal disposition to accelerate the particle represent dispositions F and G in our argument. We will see at the beginning of the next section that this interpretation may be objectionable, but for now I will proceed with the argument.

We are now led to premise 9. Whilst disposition G of *b* is responsible for *b*'s ability to prompt the action of disposition F of *a*, disposition F of *a* may equally be regarded as being responsible for *a*'s ability to prompt disposition G of *b*. In other words, F and G will be *reciprocal* powers, with the action of each being dependent upon the action of the other.

From premises 5, 6, 7, 8, and 9, it follows that the manifesting of *b*'s disposition G cannot occur until *a*'s disposition F is manifesting. If *a* itself is the triggering agent for *b*'s disposition G, and it

is in virtue of a 's disposition F that a is able to activate b 's disposition G, then what the manifesting of disposition G depends upon, ultimately, is the manifesting of a 's disposition F.

As soon as the reciprocity of dispositional interaction is established, the rest of the argument for simultaneity follows rather quickly.

Premise 11 states that if the manifesting of a 's disposition F cannot occur until b 's disposition G manifests, and the manifesting of b 's disposition G cannot occur until a 's disposition F manifests, then neither a 's disposition F nor b 's disposition G can manifest before the other. This seems correct. If there is a mutual dependence between F and G, as has been suggested, then this precludes either power being able to act before the other.

If neither a 's disposition F nor b 's disposition G can act before the other, then there would seem to be only two possible outcomes for a and b where dispositions F and G are concerned: either a and b manifest their reciprocal dispositions simultaneously, or not at all. This is what premise 12 states.

The overall conclusion we are led to, then, from intermediate conclusions 4 and 10, plus premises 11 and 12, is that if a 's disposition F and b 's disposition G are to manifest, they must manifest simultaneously.

Does the argument really establish what is intended?

An objection may run along the following lines: all the argument shows is that reciprocal *triggering* dispositions manifest simultaneously, and not, in fact, that the triggering manifestation occurs simultaneously with the manifestation *proper*, i.e. the acceleration of the particle in case we have focused upon. It may be objected that when appealing to the particle case I assumed that the manifestation of reciprocal dispositions F and G consisted in the acceleration of the particle, yet on the other hand it was claimed that dispositions F and G are responsible for the *stimulation* of the particle's charge on the one hand, and the field's power on the other. This latter claim suggests that the manifestation of F and G does not consist in the acceleration, but, rather, is something quite distinct: a triggering manifestation which, say, *causes* the acceleration. Therefore, if F and G really are the triggering dispositions, all the conclusion (13) really establishes is that triggering involves the simultaneous contribution of reciprocal triggering powers. But this is not what we what I was looking for, since I set out to show that the manifestation *proper* is simultaneous with the triggering.

In response, it must be emphasised that it would be a mistake to see a dispositional manifestation episode as involving two distinct manifestations: the manifestation of reciprocal triggering dispositions on one hand and the manifestation *proper* on the other, with the former leading to the latter. As my discussion of the particle case indicates (when discussing premise 9), I take it that the manifestation of triggering *just is* the manifestation proper¹². To suppose otherwise is, in effect, to suppose that the operation of more than two dispositions is responsible for any given manifestation episode: two reciprocal triggering dispositions plus whatever dispositions are responsible for the manifestation *proper*, i.e. the dispositions which are triggered by the reciprocal triggering dispositions. This would be excessive and go over and above what is required to explain the occurrence of manifestations like the acceleration in the particle case. Is there really an event in the particle case that can be identified as the manifestation of (reciprocal) triggering dispositions, an event distinct from the acceleration event itself? I suggest not; when we consider the particle case, there seems to be just one event taking place, an event that is the manifestation of both the force field's disposition to accelerate the particle, and the particle's reciprocal disposition to be accelerated. No more dispositions are needed in the story to account for the acceleration; it is simply a matter, in Martin's words, of 'reciprocal dispositions mutually manifesting' (2008: 50). Indeed, adding a distinct triggering manifestation to the story would just create further mysteries. What, for example, is the mechanism that gets us from the triggering manifestation (whatever that is supposed to be) to the manifestation proper?

At this point it may be further objected that, if I am right, there is ultimately no need to appeal to the concept of stimulation at all when describing manifestation episodes, and so the question I raised in the first place is inappropriate. I think this would be unfair, however. To say that the particle's disposition to accelerate requires stimulation is to do justice to the fact that the particle could not have brought about its acceleration by the operation of its charge alone. As we have observed, there is a conditional aspect to the contribution made by the powers involved in a manifestation episode. To speak of stimuli is just to speak of whatever figures in the antecedents of the conditionals associated with each and every disposition. Under the current understanding of stimuli, the trigger will be the operation of a reciprocal power (or multiple in powers in some cases¹³).

¹² My thanks to an anonymous referee for emphasising the importance of this assumption for the argument.

¹³ Some manifestation episodes involve more than two reciprocal partners. In such cases, more than one triggering agent will figure in the antecedent of the conditional associated with each disposition involved. For example, the

However, what our observations about reciprocity teach us is that whilst it may be harmless enough to view the contribution made by one of the agents in a manifestation episode to be *the* triggering factor, this must ultimately be a perspectival matter. A manifestation requires the contribution of two (or more) dispositions, and relative to each of these dispositions, the triggering factor for the resultant manifestation will be different. Consider, for example, the case of solubility often discussed by Martin: if we consider a dissolving event *qua* manifestation of water's dissolving power, the antecedent conditions will involve the soluble substance, and so its contribution will be classed as the triggering factor. On the other hand, if we consider the dissolving event *qua* manifestation of the substance's solubility, the water will be classed as the triggering agent.

In sum, the argument of this section has revealed a certain symmetry where dispositional stimulation is concerned: the action of each reciprocal disposition involved in a manifestation episode may be classed as a trigger for the manifestation of the other (or others). This is one reason why the stimulus – manifestation distinction should not, on the current understanding of the distinction, be confused with the cause – effect distinction. It seems an undeniable fact about causation that the relationship between a cause and its effect is often not, and perhaps never is, one of symmetry: typically, A is the cause of B without it being the case that B is the cause of A. This difference suggests that the stimulus – manifestation distinction does not correspond to the cause – effect distinction, and so the question whether *causes* and *effects* may occur simultaneously should be regarded as a further one. Unfortunately, this further question cannot be addressed here.

Second argument against the temporal priority of disposition stimulation

According to the alternative view about triggering, which I will now assume, the triggering of a disposition merely consists in the state of affairs of a particular with a certain disposition being contiguous with that which triggers it (or, in Martin's terminology, its reciprocal disposition partner)¹⁴.

antecedent of the conditional associated with the disposition had by a match to ignite when struck should, if it is accurate, involve reference to oxygen as well as the rough surface upon which matches have to be struck.

¹⁴ Note that this is to simplify the case somewhat; in many instances, not only must dispositional partners have to be contiguous, they must also be contiguous *in a certain way* in order to manifest the dispositions in question. Consider,

If this view of triggering is assumed, cases which appear to involve simultaneity are not hard to come by. Consider, again, the particle case. The instant at which a particle finds itself in a field is the very instant at which it begins to accelerate; it is not as though the particle remains static in the force field for a period of time before it begins to accelerate. Thus, if the trigger in this case is simply the particle's being *in* the field, and the manifestation is the acceleration, this case is one in which a temporal gap is lacking. Goodman's case of flexibility also appears to exhibit this feature. Plausibly, the point at which *k* meets a resistant substance just is the point at which the bending, i.e. the manifesting of flexibility, begins.

Wesley Salmon is one philosopher who has rightly emphasised the simultaneity involved in interaction (as opposed to causal propagation) (1984: 182). Although he does not characterise interaction in dispositional terms, the examples he uses fit nicely the dispositional model we are now considering. Salmon's main example of the simultaneity of interaction involves a light pulse meeting a red filter. Salmon remarks that 'the light becomes red *at the very time* of its passage through the filter' (1984: 182; italics added). To put this in dispositional terms, one might say that the filter has the disposition to change the colour of light, and this disposition is manifested the instant at which the filter and light make contact, i.e. the instant at which it is triggered.

It should be emphasised, however, that the argument here is empirical. One should not, therefore, automatically rule out the possibility of cases in our world in which the manifesting of a disposition does begin after it meets its reciprocal partner¹⁵. Consider, for example, the case of salt dissolving in water. Although most of us are inclined to say that salt begins to dissolve the very instant it finds itself submerged in water, when matters are considered from a micro perspective this seems not strictly true. Specifically, the bonds between the sodium and chloride in any given salt molecule are only broken once the positively charged sodium ion is surrounded by the negative part of a water molecule, and the negative chloride ion is surrounded by the positive part of the water molecule. This 'surrounding' takes time for any given salt molecule (albeit a very small amount of time), especially in cases in which the water is at a low temperature. As indicated, however, the disposition of solubility is one that is ascribed at the macro level of description. Once we focus on the micro level of description, perhaps cases of

for example, the (reciprocal) dispositions had by two playing cards to prop each other up. In order to manifest this disposition, the cards must make contact in a very specific way.

¹⁵ And one should certainly not rule out the possibility of such cases in worlds of a different kind to ours.

dissolving are reducible to chains of multiple microscopic manifestations, each of which does indeed occur simultaneously with its trigger. This is a question I leave open.

In the last section we saw that, on our first understanding of triggering, the trigger – manifestation distinction does not correspond to the cause – effect distinction. An interesting question is whether, on the current understanding of triggering, the trigger – manifestation distinction might correspond to the cause – effect distinction. Although this is not the place to consider this question in detail, I think the possibility of such a correspondence is something which should not be ruled out immediately. Yet, Martin is one philosopher who does appear to rule this out. He claims that the partnering of reciprocal dispositions (i.e. the trigger, under our current understanding) cannot be the cause of their mutual manifestation since ‘...the coming together of the disposition partners *is* the mutual manifestation’ (2008: 51). I find this claim deeply implausible, however. For one thing, there are well known cases in which a particular with a certain disposition comes into contact with its reciprocal partner, and yet the expected manifestation is prevented by an ‘antidote’ (see Bird, 1998). An example is the case in which arsenic is ingested, yet the fatal manifestation of arsenic fails to occur because of the presence also of dimercaprol (1998:228). In such cases there appears to be partnering (i.e. triggering) but no manifestation, and so partnering states of affairs must be distinct from manifestation states of affairs¹⁶.

Furthermore, in support of the equivalence of the cause – effect distinction with the trigger – manifestation distinction (on the current understanding), there does seem to be a certain asymmetry concerning the relationship between triggering and manifestation. It seems right to say that contiguity of reciprocal dispositions triggers the manifestation but not vice versa¹⁷.

¹⁶ This leads me to think that Martin conflates cases of manifestation with cases of constitution when he says that ‘...the coming together of the disposition partners *is* the mutual manifestation’ (2008: 51). This suspicion is vindicated when Martin uses the analogy of two triangular slips coming together (i.e. being ‘partnered’) and forming a square (i.e. the ‘manifestation’) (2008: 51).

¹⁷ An interesting question is as follows: what is the source of this asymmetry? If the conclusion of this paper is correct, it cannot be grounded in temporal priority. My suspicion is that this asymmetry is rooted in the asymmetry of the ontological dependence of reciprocal dispositions upon their mutual manifestation. On Bird’s view, this kind of dependence lies in second-order relations amongst disposition universals (2007: 6.3), whilst on Molnar’s view, it is cashed out in terms of the directedness of physical intentionality (2003: ch 3). Unfortunately, I must pursue this interesting issue elsewhere.

Finally, a word about cases involving finkish dispositions. To recall, Bird writes that an object's disposition is finked when '... the object loses the disposition after the occurrence of the stimulus but before the manifestation can occur...' (Bird, 2007: 25). If that which we call the a disposition's stimulus occurs simultaneously with the (beginning of) manifestation of that disposition, then it must be the case that when a fink prevents the manifestation of certain disposition, it does so by changing the disposition(s) in question *prior* to stimulation, or at the very least the instant at which the stimulus is to occur¹⁸. In fact, reflection upon cases commonly used in discussions on finks suggests that this is the case. In Martin's example, an electro-fink 'can provide itself with information as to exactly when a wire connected to it is touched by a conductor' (1994: 2), and when such contact occurs, the fink intervenes to change the wire's properties. Now crucially, Martin says that the fink reacts 'instantaneously, we are supposing' (1994: 3; *italic added*). Thus, Martin supposes there is no temporal gap between the contact of the reciprocal partners and the fink's intervention. This is not surprising. Martin's aim is to show that the truth of the conditional 'if touched by a conductor, then electrical flows from the wire to the conductor' is neither necessary nor sufficient for the wire having the disposition of being live. It is not necessary, according to Martin, because the wire could be live, yet the fink could make it dead whenever touched, thus falsifying the aforementioned conditional. Now, the reason why Martin supposes that the fink acts 'instantaneously' is, I suggest, that he is well aware that if the fink did not react *instantaneously*, the current would already have started flowing, thus making the conditional associated with 'is live' true.

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¹⁸ Another possibility is that rather than being lost after the stimulus, the disposition in question is lost before the manifestation process is completed to its full extent. Manifestation processes do, after all, take time; soluble substances clearly do not instantaneously dissolve *fully* in water, for example.

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